ECE/CS 5565 Project 4

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Part 1

1.1 I used the provided trace file for the analysis

1.2 **IP Address and TCP Port Used by the Client Computer:**
   IP Address: 172.29.38.32
   TCP Port: 64939

1.3 **IP Address and TCP Port Used by the Server Computer:**
   IP Address: 128.119.245.12
   TCP Port: 80 (standard HTTP port)

1.4 **Raw Sequence Number: `2144712284`**

1.5 The acknowledgement number in the **SYN, ACK** packet is determined based on the client's **raw sequence number** in its **SYN** message. Here's how:
   The acknowledgement number is set to **1 greater than the sequence number of the last byte received** from the client.
   In this case:
   The client's **raw sequence number** in its SYN packet was `2144712284`.
   Since the SYN flag itself occupies one byte in TCP (even though no actual data is sent), the server acknowledges the next expected sequence number:
   `2144712284`+ 1 = `2144712285`.

1.6 **Raw Sequence Number:** 2144712285
   TCP Payload Length: 585 bytes

1.7.a: Time of first segment sent: **0.024016 seconds**

1.7.b**:** Time of ACK received for first segment: **0.053382 seconds**

1.7.c: RTT for first data segment: **0.029366 seconds**

1.7.d: RTT for second data segment: **0.028993 seconds**

1.8 29200 is the smallest window size.

1.9 We don't have any re-transmitted packets. No retransmission flags are present in the SEQ/ACK analysis packet of all the TCP packets. Filtering on the tcp.analysis.retransmission in the wireshark window returns no packets.

1.10

Total Payload Transferred: The HTTP POST transfer involved **152906 bytes** of data.

Duration: The transfer took **0.126132 seconds(0.150148-0.024016)**.

Throughput (Bytes per Second): 152906 ÷ 0.126123≈ 1212269.7 Bps.

**Throughput (Bits per Second):** 1212269.7 × 8 ≈ **9698157.44bps.**

1.11

In Frame 41, the server at 128.119.245.12 initiates the process of closing the TCP connection by sending a FIN, ACK packet to the client at 172.29.38.32. The FIN signifies that the server has completed sending data and is requesting to terminate the connection. The ACK included in this packet serves to acknowledge any previously received data from the client.

Following this, the client (172.29.38.32) responds with an ACK packet, confirming that it has received the server's FIN and agreeing to proceed with the connection closure.

- Packet 41: Server starts the termination process by sending a FIN, ACK.

- Packet 42: Client acknowledges the server's FIN by sending an ACK.

Part 2

2.1

Sequence Numbers (Stevens) for 172.29.38.32:64939 → 128.119.245.12:80
project4_tcp.pcapng
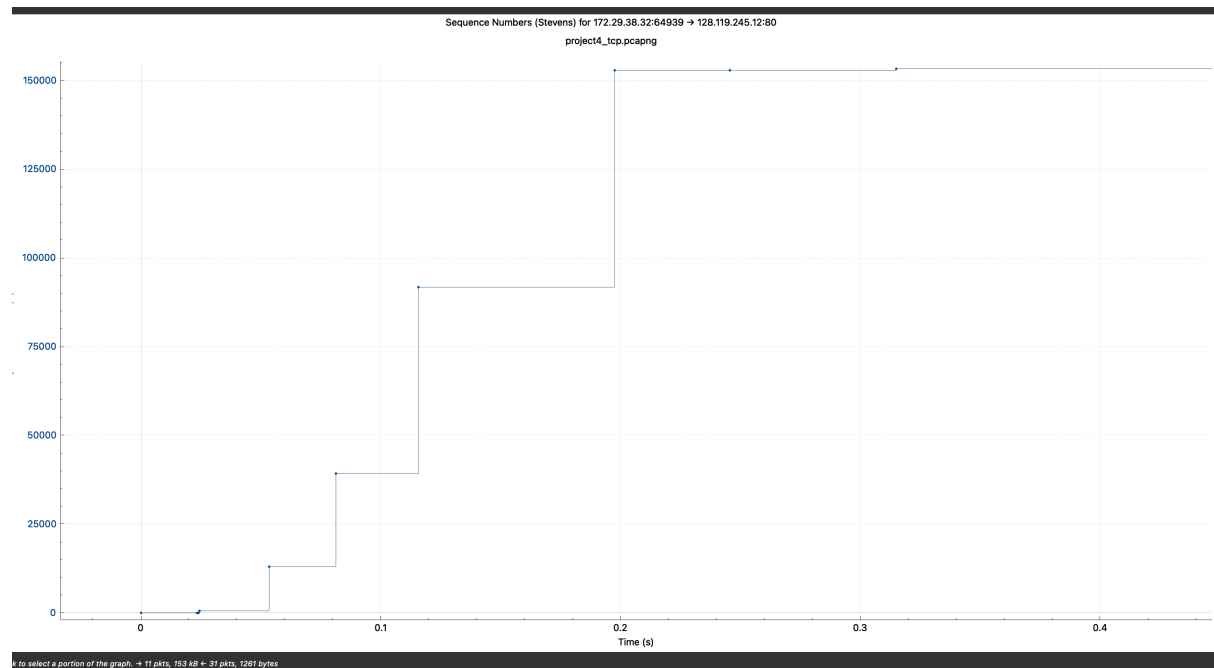
2.2

We start from the 4th frame in the graph.

The sequence number change is as follows:

First step: 1 -> 586

Second step: 586 -> 13024

Third step: 13024 -> 39282

Fourth step: 39282 -> 91798

2.3

TCP is in the **slow-start phase** during this time. The sequence numbers increase rapidly, showing exponential growth. This behaviour matches TCP slow-start, where the congestion window doubles with each round-trip time (RTT). The growth is too fast for congestion avoidance, which would show more linear increases.

Part 3- Summary

No problems were encountered in this project.